MSc Thesis Presentation

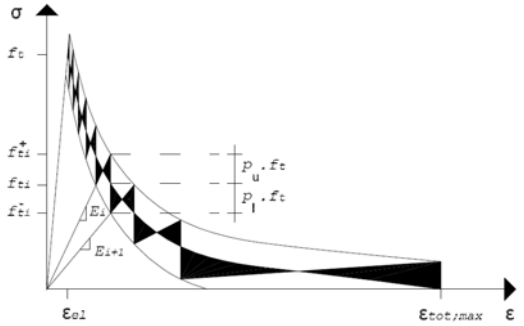
Sequentially Linear Analysis of Shear Critical Reinforced Concrete Beams

Name : **A.T. Slobbe**
Department : **Structural Engineering**
Computational Modeling of Structures

Graduation professor : **Prof. Dr. Ir. J.G. Rots**
Supervisors : **Dr. Ir. M.A.N. Hendriks**
Ir. A.V. van de Graaf
Ir. J.A. den Uijl
Ir. L.J.M. Houben

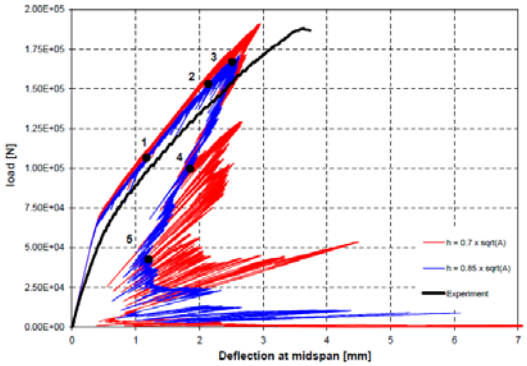
Sequentially linear analysis (SLA), as alternative to nonlinear finite element analysis, uses a series of linear analyses as a sequence of "events" resulting in the avoidance of convergence- and bifurcation problems. For this approach, the softening curve of negative slope in the constitutive stress-strain relation is replaced by a discretized, saw-tooth diagram of positive slopes. It makes the SLA-method attractive to analyze large-scale brittle structures.

The research objective of this graduation project is to find a robust way of modeling shear critical reinforced concrete beams. Such beams fail by shear failure mechanisms, which are generally brittle of nature and often accompanied with sudden, large crack formations. The main research question is whether SLA is able to simulate the brittle failure behavior of shear critical beams or not. In order to answer this question, sequentially linear analyses are performed on tested shear critical beams. The results of these analyses are assessed in relation to results of comparable performed, nonlinear analyses and the experimental results.

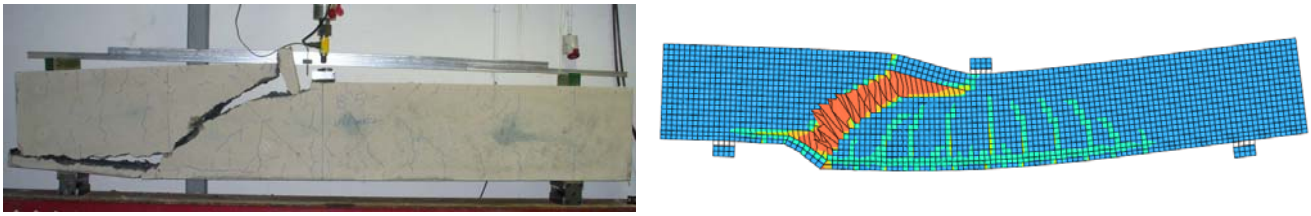


Saw-tooth constitutive relation

In the analyses a fixed crack model is employed, for which shear retention properties must be addressed. It appears that the choice for either a constant or a variable shear retention relation considerably affects the numerical results. Sequentially linear analyses, using a variable shear retention relation, are able to simulate the brittle failure behavior of the experiment properly, both in terms of load-displacement response and crack development. The sensitivity of the obtained results from these analyses, with respect to mesh refinement, the adopted amount of fracture energy and the size of the finite element beam model is investigated.



Load-displacement response



Crack pattern after failure of the experiment (left) and numerical results (right)

Presentation will be held <u>in Dutch</u>

Date : **25 – 05 – 2010**
Time : **15.30u – 16.30u**
Place : **Faculty of Civil Engineering & Geosciences**
2628 CN Delft, Stevinweg 1
Lecture room C

TU Delft Delft University of Technology